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DE-B- 1 751 953
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GB-A- 2 150 220
US-A- 4 570 584
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EP 0 279 446 B1

Description

This invention relates to an air-cooled internal combustion engine comprising a vertically oriented crank shaft, a cylinder disposed in a generally horizontally extending direction, an intake valve for controlling the flow of an intake charge into a combustion chamber, an exhaust valve for controlling the flow of exhaust gases from said combustion chamber, means lying on one side of said cylinder for operating said intake valve and said exhaust valve, an intake passage formed in said cylinder head and extending from said intake valve toward one side of said cylinder head to an intake device disposed on said one side and an exhaust passage formed in said cylinder head and extending toward the opposite of said cylinder head from said exhaust valve to a muffler. The improvement of the present invention is that the exhaust passage is positioned at a level above the inlet passage, the exhaust passage extending inclined upwardly to a face at a corner of said cylinder head to shorten the length of said exhaust passage in order to minimise the heat transferred to the cylinder head.

Air-cooled engines find a wide variety of applications. One of the large volume applications for such engines is in powering certain implements such as walk-behind rotary lawn mowers. With such applications, the engine is normally positioned with the cylinder extending in a horizontal direction and with the output shaft rotating about a vertically extending axis. This has particular utility because it permits the engine output shaft to he directly coupled to the cutting blade, which rotates about a vertically extending axis, and thus affords a simple construction. However, there are a wide variety of difficulties in connection with the air cooling of an engine having such an orientation.

Specifically, one of the problems in cooling an engine of this configuration is that the air flow generally flows in a downward direction over the engine and specifically the cylinder barrel for its cooling. However, the immediately adjacent configuration of the lawn mower housing tends to obstruct such flow and may, in fact, redirect it so that the hot gases are directed across a portion of the engine which should be cooled or at least not heated. For example, it is very desirable to maintain the carburetor of the engine at a relatively low temperature so as to improve the induction efficiency and to preclude the evaporation of fuel from the heat of the engine. On the other hand, the carburetor of the engine should not be unduly heated. In addition to the problem of cooling the carburetor and preventing undue heating of it, it is also desirable to maintain the carburetor in relatively close proximity to the combustion chamber. Since the combustion chamber is one of the hottest portions of the engine, there is a tendency to attempt to position the carburetor at a remote distance from the cylinder head and combustion chamber so as to avoid the aforenoted heat problems. However, as the runner passage from the carburetor to the combustion chamber increases in length, starting, particularly at low temperatures, becomes difficult.

Utility engines employed for driving implements such as rotary lawn mowers have frequently used very simple engines having L-head construction. Although the simplicity of such engines have a number of advantages, the performance of these engines are considerably reduced from those of overhead valve engines. However, if a small overhead valve engine is employed and is utilized in conjunction with an implement such as a rotary lawn mower, certain difficulties arise in connection with the air cooling of the engine. For example, the positioning of the various components such as the exhaust manifold, muffler and air cleaner can, as aforenoted, present certain difficulties.

Regarding the cooling of overhead valve internal combustion engines by air systems, it is normally the practice to operate valves by means of rocker arms that are pivotally supported within the cylinder head and are operated by means of push rods. However, it is important to ensure that the valve operating components are also adequately cooled.

An air-cooled internal combustion engine as indicated above is known from US-A-4,570,584. In that case, the outer openings of the intake and exhaust passages are disposed to be located substantially at the same height providing a relatively long exhaust passage.

Accordingly, it is an objective of the present invention to provide an improved air-cooled internal combustion engine as indicated above, rendering the engine very compact without deteriorating the cooling efficiency thereof, specifically rendering the exhaust passage short in order to reduce the heat transfer to the cylinder head.

In order to perform that objective, the present invention provides an air-cooled internal combustion engine as indicated above with the particularities in that preferred embodiments of the present invention are laid down in the subclaims.

In the following, an embodiment of the present invention is explained in conjunction with the accompanying drawings, wherein:

Figure 1 is a perspective side view of a rotary lawn mower constructed in accordance with an embodiment of the invention and powered by an internal combustion engine constructed in accordance with an embodiment of the invention.

Figure 2 is an enlarged top plan view of the lawn mower.

Figure 3 is a further enlarged elevational view taken in the direction of the arrow 3 in Figure 1.
Figure 4 is an enlarged cross-sectional view taken along the line 4-4 of Figure 2.
Figure 5 is a cross-sectional view taken along the line 5-5 of Figure 4.
Figure 6 is a top plan view of cylinder head assembly showing the valve operating mechanism with the valve cover removed and is taken generally in the direction of the arrow 6 in Figure 4.
Figure 7 is an enlarged cross-sectional view taken along the line 7-7 of Figure 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring first primarily to Figures 1 and 2, a rotary walk-behind lawn manner constructed in accordance with an embodiment of the invention is identified generally by the reference numeral 11. Although certain features of the invention have particular utility in connection with such types of lawn mowers, other facets of the invention can be employed in other applications for internal combustion engines than rotary lawn mowers. However, the invention, as has been noted, has particularly utility in connection with rotary lawn mowers or in connection with implements that require an input shaft that rotates about a generally vertically extending axis, as is the case with a rotary lawn mower.

The lawn mower 11 includes an outer housing 12 that may be formed from any material such as a cast metal or the like and which is supported at its front end by front wheels 13 and at its rear end by rear wheels 14. If desired, the rear wheels 14 may be driven in an appropriate manner so as to provide a self-propelled lawn mower.

The housing 12 includes a scroll portion 15 that has an upper wall that is generally helical in configuration and which extends from a low portion that is disposed immediately adjacent the upper end of a cutting blade 16 to a raised discharge portion 17 which is disposed immediately adjacent a rearwardly facing discharge chute. A grass catcher bag 18 may be carried by the rear end of the number so as to receive grass that is cut and thrown through this discharge chute. A handle 19 extends rearwardly from the main body portion 12 and overlies and supports the grass catcher bag 18 in a known runner. A throttle control 21 is carried by the rear portion of the handle 19 for controlling the speed of the mower.

An internal combustion engine, indicating generally by the reference numeral 22, is supported on the main housing 12 of the lawn mower 11 in an appropriate manner by means of mounting bolts 23 that extend through lugs 24 formed in a crankshaft 25 of the engine 22 (Figure 4). The mounting bolts 23 are threaded into cooperating openings in the housing 12 of the mower. As may be seen in Figure 4, the engine 22 is of the single-cylinder type and is disposed so that the engine crankshaft 26 rotates about a generally vertically extending axis. A coupling 27 is affixed to the lower end of the crankshaft 26 and is coupled by means of bolts 28 to the cutting blade 16 for driving it about a vertically extending axis. An impeller fan blade 29 may be affixed between the coupling 27 and the cutting blade 16 for generating an air flow through the scroll housing portion 15 so as to cause the grass to be raised and discharged through the discharge chute.

Referring now primarily to Figures 3 through 7 and initially primarily to Figures 4 and 5, the engine 22 includes a cylinder barrel 31 that forms a single horizontally disposed cylinder bore 32. The cylinder bore 32 slidably supports a piston 33 that is connected by means of a connecting rod 34 to a throw of the crankshaft 26. The crankshaft 26 is rotatably journaled by means of an upper main bearing 35 in an upper crankcase portion 36 which is formed integrally with the cylinder barrel 31. The lower end of the crankshaft 26 is rotatably journaled in a plain bearing formed in the crankcase 25.

The cylinder head 37 is affixed to the cylinder block 31 in a known runner as by bolts 38. The cylinder head 37 is provided with a recessed area which cooperates with the head of the piston 34 and cylinder bore 32 to form the combustion chamber. An exhaust valve 39 is slidably supported within the cylinder head 37 by means of an appropriate valve guide and is positioned vertically above an intake valve 41 which is also supported by means of a valve guide in the cylinder head 37. The intake valve 41 and exhaust valve 39 are disposed generally in a vertical plane and lie at one side of the cylinder bore 32 as may be best seen in Figures 5 and 7.

The exhaust valve 39 cooperates with an exhaust valve seat 42 that defines a portion of an exhaust passage 43 that extends through the upper portion of the cylinder head 37 from the combustion chamber to a face 44 formed upwardly and at one side of the cylinder head 37. An exhaust pipe 45 cooperates with the cylinder head exhaust head passage 43 so as to deliver exhaust gases from the combustion chamber to a muffler 46 that is contained within a heat insulating baffle 47 formed at one side of the cylinder bore 32. It should be noted from Figure 7 that the length of the cylinder head exhaust passage L is relatively short due to the location and configuration of the exhaust passage 43 so as to improve cooling and minimize the heat transferred to the cylinder head 37.

The intake valve 41 cooperates with a valve seat 48 that is pressed into the cylinder head 37 and which defines one end of an intake passage 49 that extends through the cylinder head 37 in a direction opposite to the direction of extent of exhaust passage 43 and which is positioned vertically beneath it. Like the exhaust passage, the intake passage 49 is relatively short so as to place it in close proximity to a carburetor 51 which is affixed directly to the cylinder head 37 and which delivers a fuel/air charge to the combustion chamber. An air cleaner 52 is affixed to the air horn of the carburetor 51 for delivering clean air to the carburetor.

It should be noted that the carburetor 51 is positioned on the opposite side of the engine from the muffler 46 so as to reduce the heat transfer between these two elements. In addition, the carburetor 51 is positioned above the raised portion of the scroll part 15 of the main body portion 12 of the mower adjacent the discharge chute so as to place it above the path of hot air, as will become apparent.

The cylinder head 37 is provided with a tapped hole 53 into which a spark plug 54 is threaded. The spark plug 54 is fired by means of a suitable ignition system which includes a magneto generator formed in part by means of a fly wheel 55 that is affixed to the upper end of the crankshaft 26 by means of a nut 56.

Exhaust and intake rocker arms 57 and 58 are supported for pivotal implements relative to the cylinder head by means of rocker arm pivots 59 and 61, respectively. The mower arms 57 and 58 have one of their ends engaged with the stems of the valves 39 and 41, respectively. Coil compression springs 62 and 63 cooperate with keepers affixed to the valve stems for urging the valves 39 and 41 to their closed position.

Exhaust and intake push rods 64 and 65 extend through recesses 66 and 67, respectively, formed in one side of the cylinder head 37 and through a corresponding portion of the cylinder block 31. As a result, the push rods 64 and 65 are surrounded by a large mass of both the cylinder head 37 and cylinder block 31 so as to promote heat transfer and cooling. .

The lower ends of the push rods 64 and 65 are engaged with tappets 68 that are slidably supported in the lower end of the cylinder block 31 and which tappets 68 cooperate with lobes 69 of a camshaft for opening and closing the valves 39 and 41 in a known runner. This camshaft has a timing gear 71 that is drivingly engaged with a timing gear 72 affixed to the crankshaft 26 for driving the camshaft at 1/2 crankshaft speed as is well known in this art.

The camshaft also carries a worm gear 73 that is enmeshed with a wormwheel 74 affixed to one end of an auxiliary output shaft 75 so as to permit driving of the rear lawn mower wheels 14 in the event self-propulsion is desired.

The cylinder head and specifically the rocker arms 57 and 58 and the valve mechanism is enclosed by a rocker arm cover 76 that is affixed in a suitable manner to the cylinder head 37.

The engine 22 is air cooled and to this end the cylinder barrel 31 is provided with cooling fins 77 which are formed integrally with it. The cylinder head 35 may also be appropriately finned, if desired. In order to drive cooling air across the engine, the fly wheel 55 is provided with a plurality of upwardly extending, integrally formed fan blades 78. The fan blades 78 cooperate to draw cooling air through atmospheric air inlet 79 formed in an upper portion 81 of a cover assembly. The cover assembly portion 81 is fixed to a main shroud portion 82 that extends across the main portion of the engine for directing the cooling air from the fan blades 78 and inlet opening 79 downwardly toward the mower main housing portion 12. The helical configuration of the upper surface of the scroll portion 15 causes this downwardly flowing air to turn as shown by the arrows in Figure 3 and exit at a side of the mower 11. As has been noted, the carburetor 51 is positioned vertically upwardly because of its juxtaposition to the higher portion of the scroll portion 15 so that it will not receive any heated air from the engine. The muffler 46, on the other hand, is positioned at the upper portion of the engine as is the exhaust passage 43 so that these more highly heated parts will be cooled first and enjoy good cooling. Also, the push rods 64 are disposed at the side of the engine and they also will be effectively cooled. This cooling is assisted as is previously noted, by the mass of the cylinder block and cylinder head which encircles the push rod 64.

A fuel tank 83 is positioned rearwardly of the engine and is disposed so that it will not receive any significant amount of the heating cooling air.

The engine is provided with a pull starter including a starter handle 84 and starter mechanism 85 and this completes the engine construction.

It should be readily apparent from the foregoing description that the configuration and layout of the engine 22 and its cooperation with the mower housing 12 is such that the engine will be effectively cooled and this heat will be readily dissipated without heating the carburetor or fuel system of the engine. Also, the layout is such that the cooling will be very good and this affords a long life for the engine.

The foregoing description, as has already been noted, is that of a preferred embodiment of the invention and various modifications and changes may be made without departing from the spirit and scope of the invention as defined by the appended

claims.

Claims

1. An air-cooled internal combustion engine (22) comprising a vertically oriented crank shaft (26), a cylinder (31) disposed in a generally horizontally extending direction, an intake valve (41) for controlling the flow of an intake charge into a combustion chamber, an exhaust valve (39) for controlling the flow of exhaust gases from said combustion chamber, means lying on one side of said cylinder for operating said intake valve and said exhaust valve, an intake passage (49) formed in said cylinder head (37) and extending from said intake valve (41) toward one side of said cylinder head to an intake device disposed on said one side, an exhaust passage (43) formed in said cylinder head (37) and extending toward the opposite of said cylinder head (37) from said exhaust valve (39) to a muffler (46),
characterized in that
the exhaust passage (43) is positioned at a level above the inlet passage (49), the exhaust passage (43) extending inclined upwardly to a face (44) at a corner of said cylinder head (37) to shorten the length (L) of said exhaust passage (43) in order to minimise the heat transferred to the cylinder head (37).

2. An air-cooled internal combustion engine as claimed in claim 1 wherein the cylinder (31) includes a cylinder head (32) closing one end of the cylinder (31), the intake and exhaust ports (43, 49) being formed in said cylinder head (32) and the intake and exhaust valve (39, 41) being supported in said cylinder head.

3. An air-cooled internal combustion engine as claimed in claim 1 or 2 for driving a rotary lawn mower wherein the members (64, 65) for operating the intake and exhaust valve (39, 41) are contained within the cylinder (31) for promoting heat transfer therebetween, so that said cylinder (31) surrounds said members (64, 65) to assist heat dissipation therefrom.

4. An air-cooled internal combustion engine as claimed in at least one of claims 1 to 3 wherein the means for operating the valves (39, 41) comprises push rods (64, 65).

5. An air-cooled internal combustion engine as claimed in at least one of the preceding claims 1 to 4, **characterized in that,** an inlet portion of the induction device comprises a carburetor (51) and an air cleaner (52) affixed to the carburetor (51).

6. An air-cooled internal combustion engine as claimed in at least one of the preceding claims 1 to 5, **characterized in that,** the exhaust system of the engine is disposed on a side of the cylinder (31) opposite to the carburetor (51).

7. An air-cooled internal combustion engine as claimed in at least one of the preceding claims 1 to 6, **characterized in that,** the muffler (46) is positioned vertically above the adjacent surface of a scroll portion (46, 15) of the outer portion (46, 15) of the outer housing (12) of the rotary lawn mower supporting said engine.

8. An air-cooled internal combustion engine as claimed in at least one of the preceding claims 1 to 7, **characterized in that,** the inlet portion of the induction device is positioned vertically above a raised portion (17) of an upper surface of the scroll portion (15) of the lawn mower's outer housing.

9. An air-cooled internal combustion engine as claimed in at least one of the preceding claims 1 to 8, **characterized in that,** the push rods (64, 65) for operating the intake and exhaust valves (39, 41) are contained within the cylinder (31) for promoting heat transfer therebetween, extending through recesses (66, 67) formed in one side of the cylinder head (37) and corresponding portion of the cylinder block (31).

Patentansprüche

1. Luftgekühlte Brennkraftmaschine (22) mit einer vertikal orientierten Kurbelwelle (26), einem Zylinder (31), angeordnet in einer im wesentlichen sich horizontal erstreckenden Richtung, einem Einlaßventil (41) zur Steuerung der Strömung einer Einlaßladung in eine Verbrennungskammer, einem Auslaßventil (39) zur Steuerung der Strömung des Abgases aus der Verbrennungskammer, einer Einrichtung, die an einer Seite des Zylinders liegt, zur Betätigung des Einlaßventiles und des Auslaßventiles, einem Einlaßkanal (49), ausgebildet in dem Zylinderkopf (37), der sich von dem Einlaßventil (41) zu einer Seite des Zylinderkopfes zu einer Einlaßvorrichtung erstreckt, die an dieser einen Seite angeordnet ist, einem Auslaßkanal (43), ausgebildet in dem Zylinderkopf (37), der sich zur gegenüberliegenden Seite des Zylinderkopfes (37) von dem Auslaßventil (39) zu einem Auspufftopf (46) erstreckt,

dadurch gekennzeichnet,
daß der Auslaßkanal (43) auf einem Niveau über dem Einlaßkanal (49) angeordnet ist, wobei der Auslaßkanal (43) sich geneigt nach oben zu einer Fläche (44) an einer Ecke des Zylinderkopfes (37) erstreckt, um die Länge (L) des Auslaßkanales (43) zu verkürzen, um die auf den Zylinderkopf (37) übertragene Wärme zu minimieren.

2. Luftgekühlte Brennkraftmaschine nach Anspruch 1, bei der der Zylinder (31) einen Zylinderkopf (32), der ein Ende des Zylinders (31) abschließt, enthält, wobei die Einlaß- und Auslaßöffnungen (43, 49) in dem Zylinderkopf (32) ausgebildet sind und das Einlaß- und Auslaßventil (39, 41) in dem Zylinderkopf gelagert sind.

3. Luftgekühlte Brennkraftmaschine nach Anspruch 1 oder 2, zum Antrieb eines Rotations-Rasenmähers, bei dem die Teile (64, 65) zur Betätigung des Einlaß- und Auslaßventiles (39, 41) innerhalb des Zylinders (31) angeordnet sind, um den Wärmeübergang zwischen diesen zu unterstützen, so daß der Zylinder (31) die Teile (64, 65) umgibt, um die Wärmeableitung von diesen zu unterstützen.

4. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 3, bei der die Einrichtung zur Betätigung der Ventile (39, 41) Druckstangen (64, 65) aufweist.

5. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 4, **dadurch gekennzeichnet,** daß ein Einlaßabschnitt der Ansaugvorrichtung einen Vergaser (51) und einen Luftreiniger (52), befestigt an dem Vergaser (51), aufweist.

6. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 5, **dadurch gekennzeichnet,** daß das Auslaßsystem des Motors an einer Seite des Zylinders (31) angeordnet ist, die dem Vergaser (51) gegenüberliegt.

7. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 6, **dadurch gekennzeichnet,** daß der Auspufftopf (46) vertikal über der benachbarten Oberfläche eines Spiralabschnittes (46, 15) des äußeren Teiles (46, 15) des äußeren Gehäuses (12) des Rotations-Rasenmähers angeordnet ist, das den Motor lagert.

8. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 7, **dadurch gekennzeichnet,** daß der Einlaßabschnitt der Ansaugvorrichtung vertikal über einem höheren Abschnitt einer Oberseite des Spiralabschnittes (15) des äußeren Gehäuses des Rasenmähers angeordnet ist.

9. Luftgekühlte Brennkraftmaschine nach zumindest einem der vorhergehenden Ansprüche 1 bis 8, **dadurch gekennzeichnet,** daß die Druckstangen (64, 65) zur Betätigung des Einlaß- und Auslaßventiles (39, 41) innerhalb des Zylinders (31) zur Unterstützung des Wärmeüberganges zwischen diesen Teilen angeordnet sind und sich durch Ausnehmungen (66, 67) erstrecken, die in einer Seite des Zylinderkopfes (37) und einem korrespondierenden Abschnitt des Zylinderblockes (31) ausgenommen sind.

Revendications

1. Moteur à combustion interne (22) refroidi à l'air, comportant un vilebrequin (26) orienté dans une direction verticale, un cylindre (31) disposé suivant une direction généralement horizontale, une soupape d'admission (41) pour commander l'écoulement d'une charge d'admission à l'intérieur de la chambre de combustion, une soupape d'échappement (39) pour commander l'écoulement des gaz d'échappement depuis ladite chambre de combustion, des moyens situés sur un côté dudit cylindre pour actionner ladite soupape d'admission et ladite soupape d'échappement, un passage d'admission (49) formé dans ladite culasse (37) et s'étendant depuis ladite soupape d'admission (41) vers un des côtés de ladite culasse jusqu'à un dispositif d'admission disposé sur ledit côté, un passage d'échappement (43) formé dans ladite culasse (37) et s'étendant vers la partie opposée de ladite culasse depuis ladite soupape d'échappement (39) jusqu'à un silencieux (46),
caractérisé en ce que
le passage d'échappement (43) est positionné à un niveau situé au-dessus du passage d'admission (49), le passage d'échappement (43) s'étendant dans une direction inclinée vers le haut jusqu'à une face (44) située à un coin de ladite culasse (37) pour raccourcir la longueur (L) dudit passage d'échappement (43) afin de réduire au minimum le transfert de chaleur vers la culasse (37).

2. Moteur à combustion interne refroidi à l'air selon la revendication 1, dans lequel le cylin-

dre (31) comporte une culasse (37) fermant une extrémité du cylindre (31), les lumières d'admission et d'échappement (43, 49) étant formées dans ladite culasse (37) et les soupapes d'admission et d'échappement (39, 41) étant supportées par ladite culasse.

3. Moteur à combustion interne refroidi à l'air selon les revendications 1 ou 2, pour l'entraînement d'une tondeuse à gazon rotative, dans lequel les organes (64, 65) destinés à actionner les soupapes d'admission et d'échappement (39, 41) sont contenus à l'intérieur du cylindre (31) pour faciliter le transfert de chaleur entre ces organes de telle sorte que ledit cylindre (31) entoure lesdits organes (64, 65) pour contribuer à la dissipation thermique depuis ces organes.

4. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 3, dans lequel les moyens d'actionnement des soupapes (39, 41) comportent des tiges-poussoirs (64, 65).

5. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 4, caractérisé en ce qu'une partie d'admission du dispositif d'aspiration comporte un carburateur (51) et un filtre à air (52) fixé au carburateur (51).

6. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 5, caractérisé en ce que le système d'échappement du moteur est disposé sur un côté du cylindre (31) opposé au carburateur (51).

7. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 6, caractérisé en ce que le silencieux (46) est positionné verticalement au-dessus de la surface adjacente d'une partie en volute (46, 15) de la partie extérieure (46, 15) du carénage extérieur (12) de la tondeuse à gazon rotative supportant ledit moteur.

8. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 7, caractérisé en ce que la partie d'admission du dispositif d'aspiration est positionnée verticalement au-dessus d'une partie relevée (17) d'une surface supérieure de la partie en volute (15) du carénage extérieur de la tondeuse à gazon.

9. Moteur à combustion interne refroidi à l'air selon l'une au moins des revendications 1 à 8, caractérisé en ce que les tiges-poussoirs (64, 65) pour l'actionnement des soupapes d'admission et d'échappement (39, 41) sont contenues à l'intérieur du cylindre (31) pour contribuer au transfert de chaleur entre ces organes, et s'étendent à travers des évidements (66, 67) ménagés dans un côté de la culasse (37) et une partie correspondante du bloc-cylindre (31).

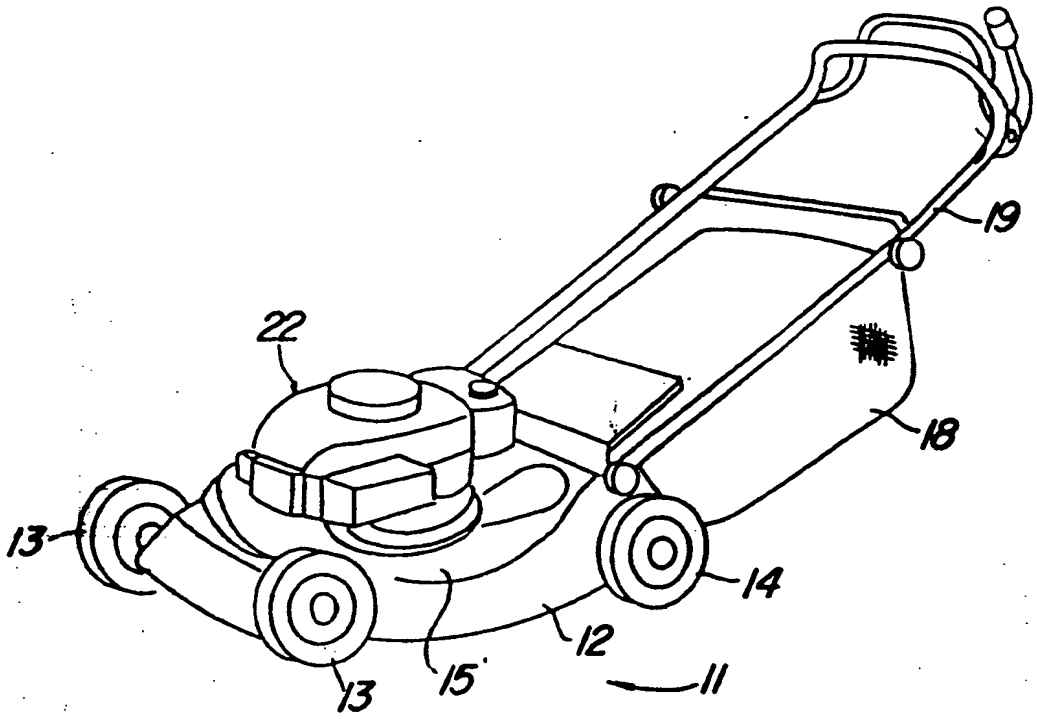

Fig-1

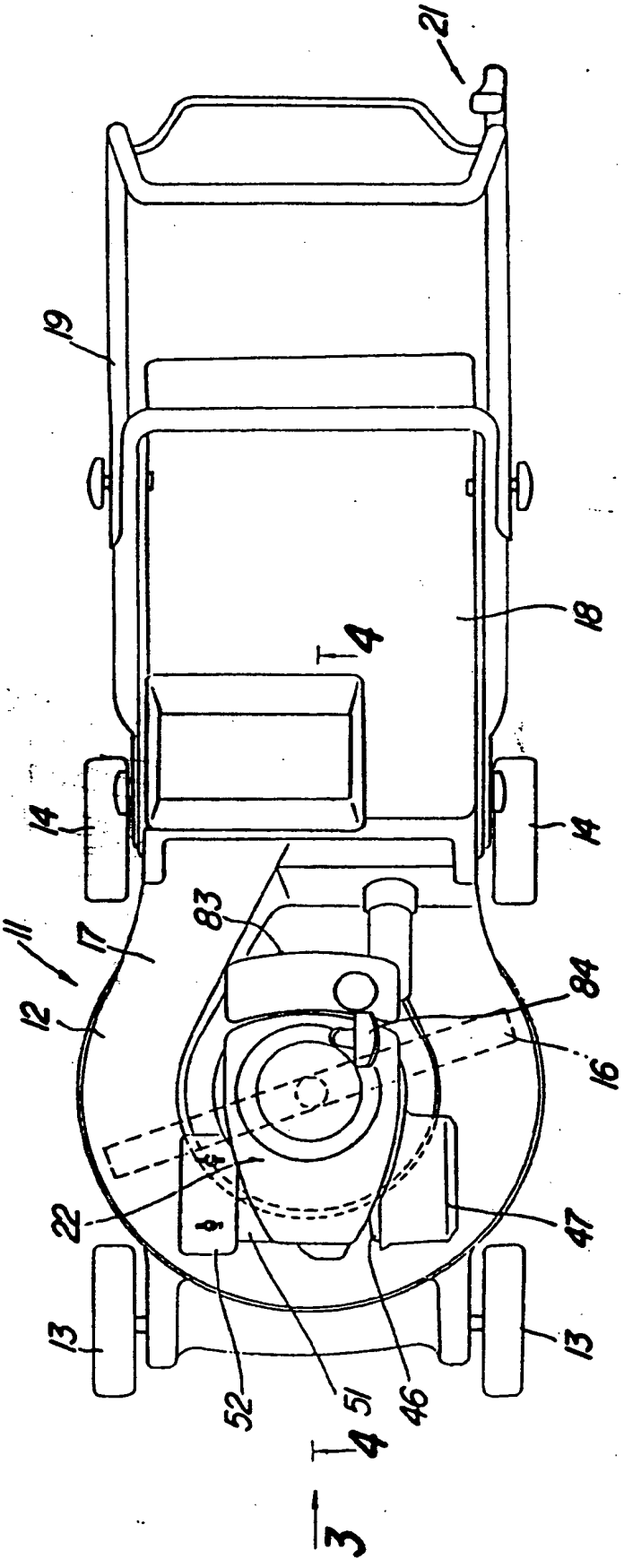

Fig-2

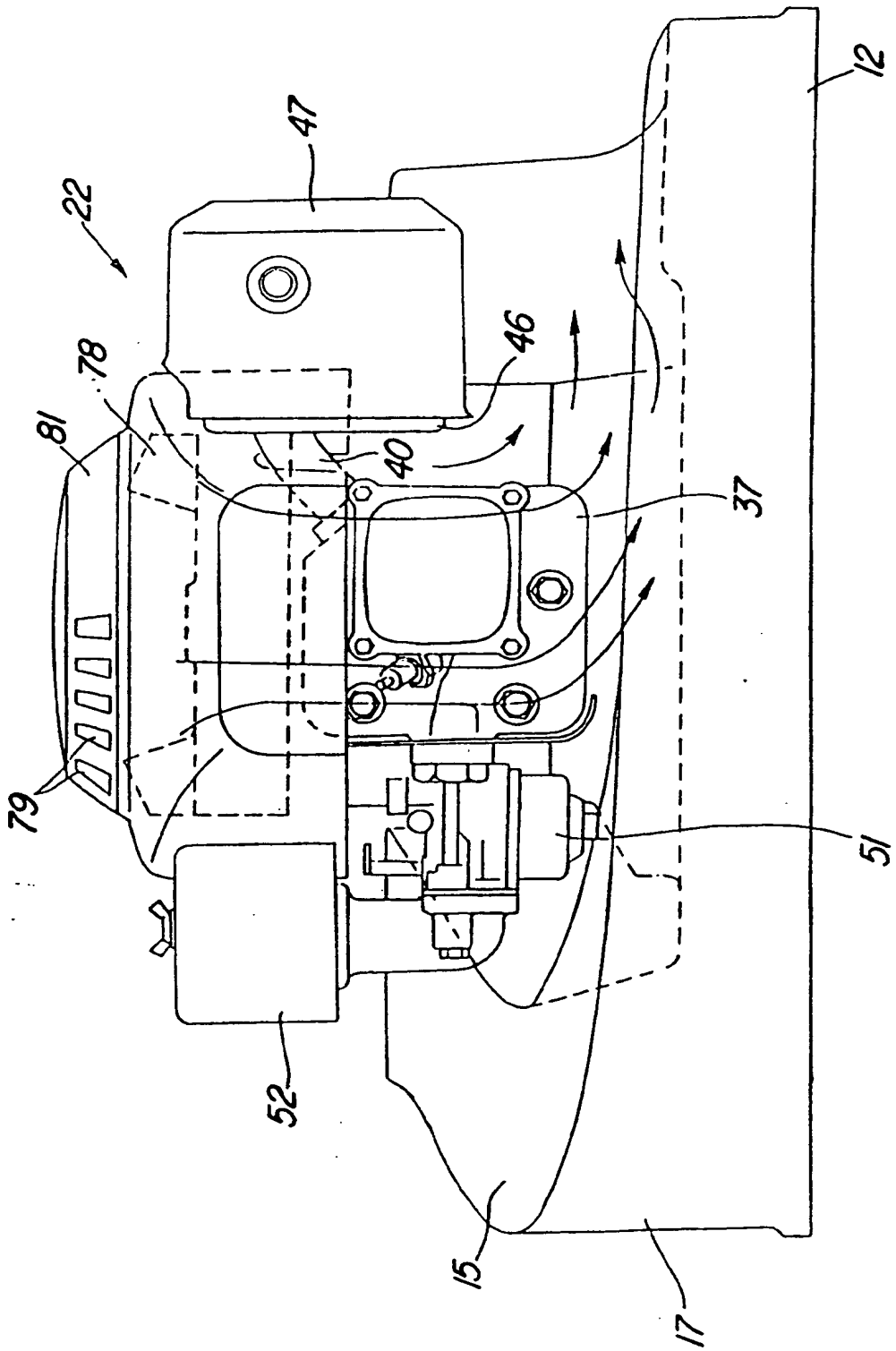

Fig-3

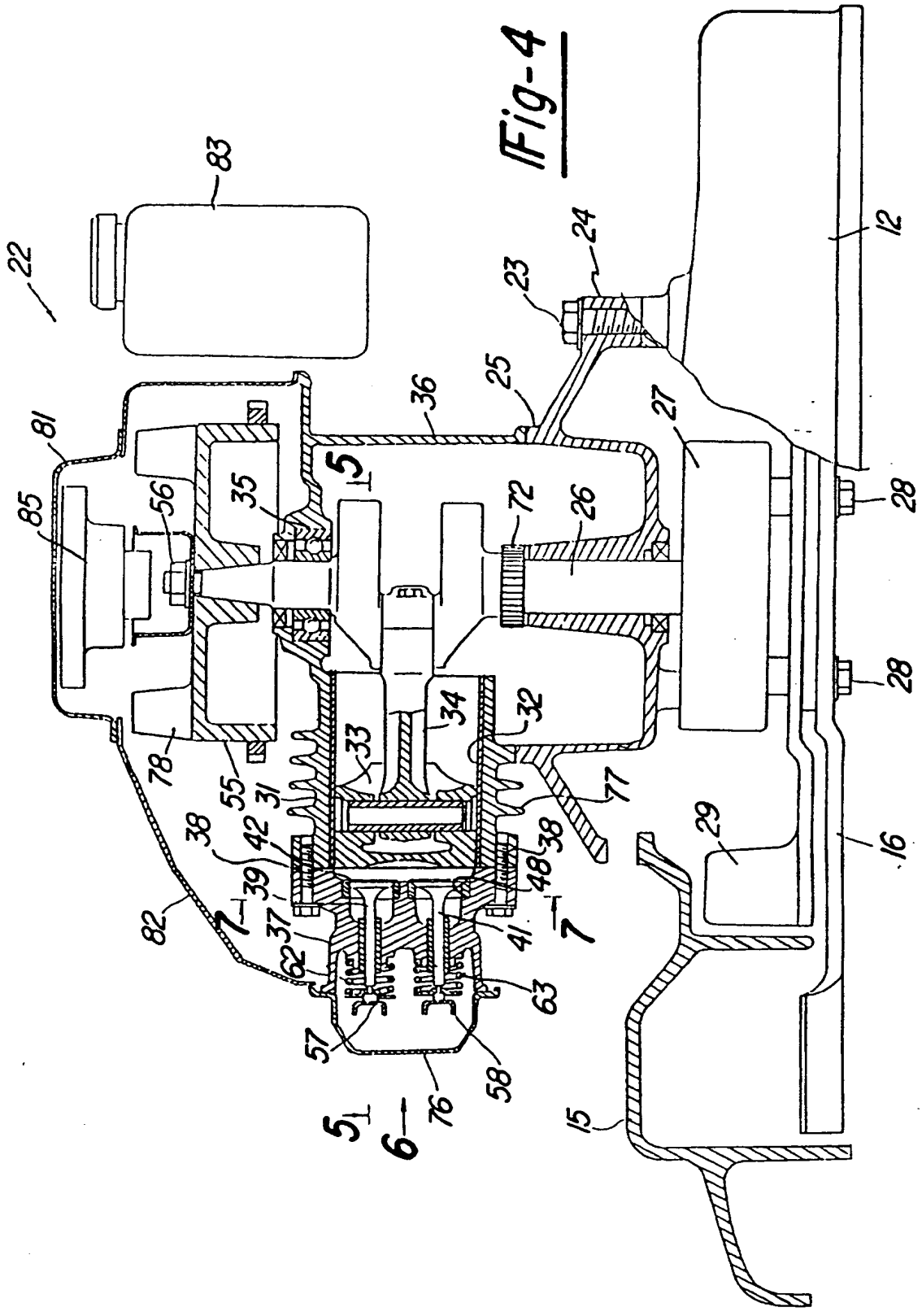
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Fig-4

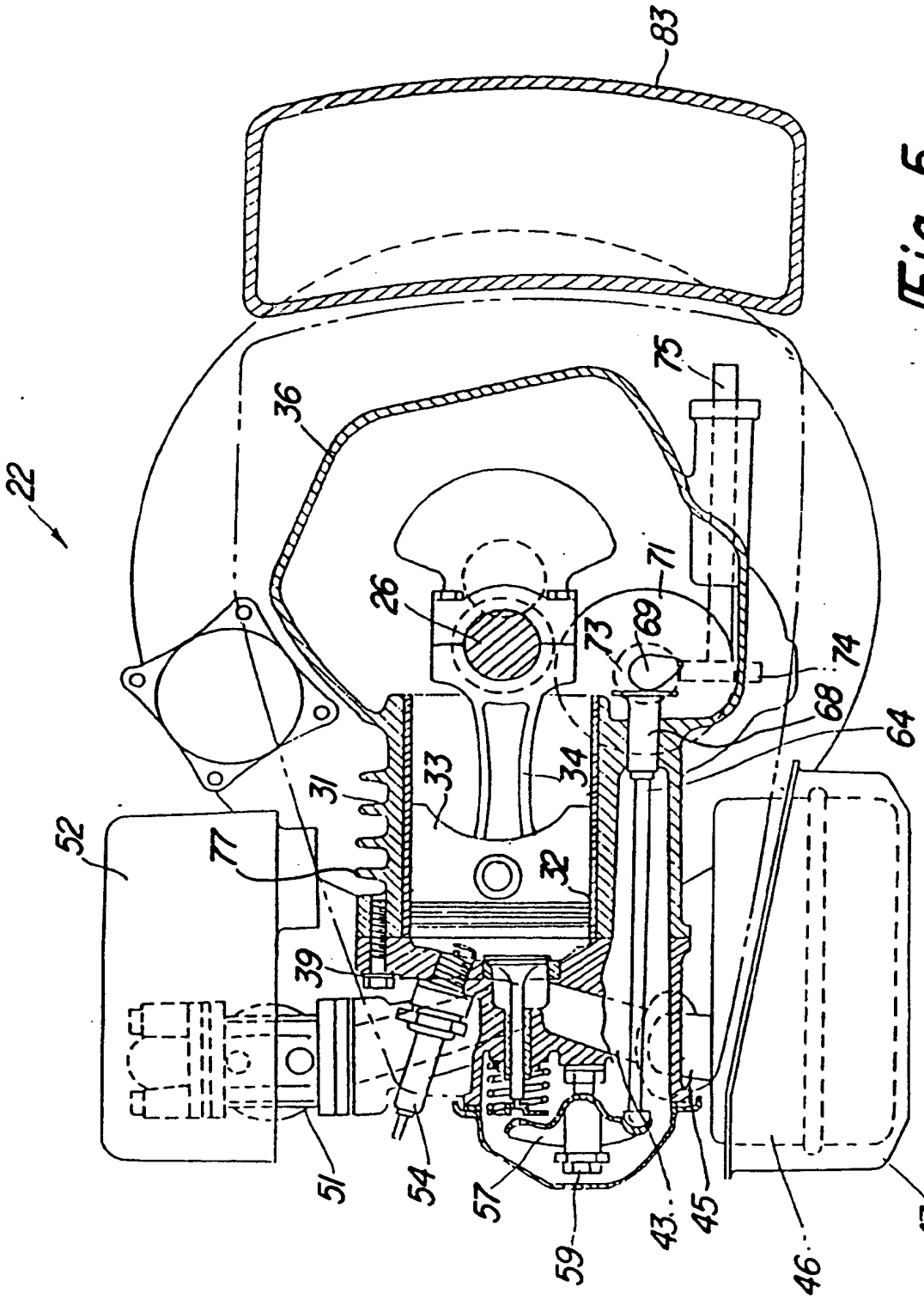
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Fig-5

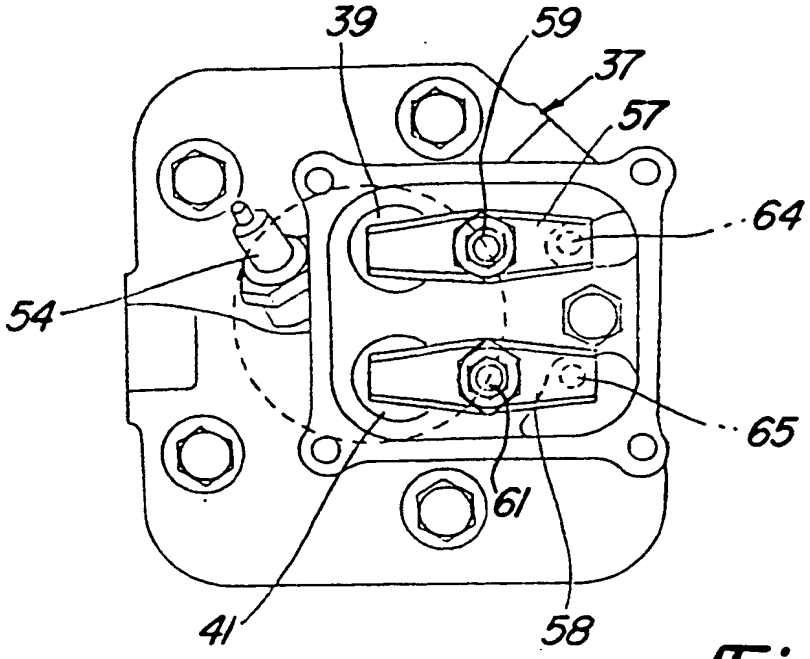

Fig-6

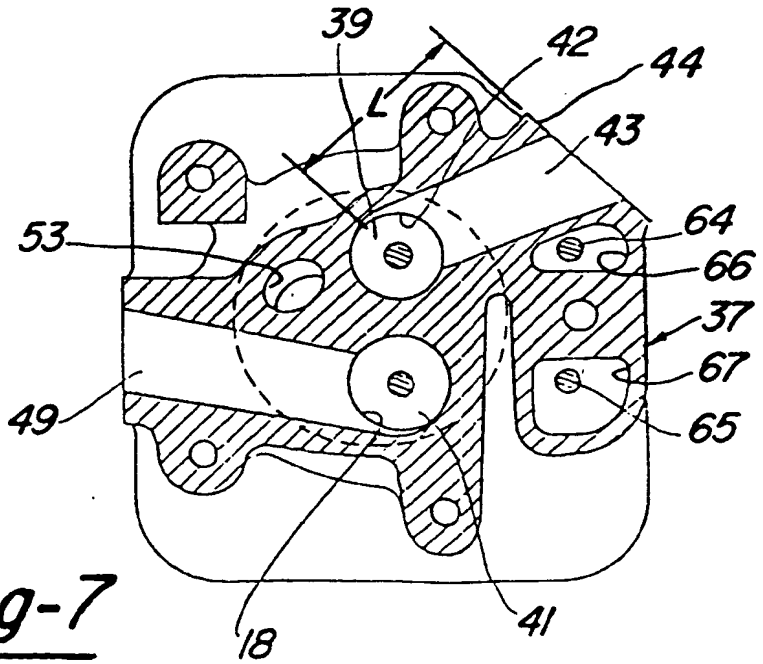

Fig-7